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17 January 1957

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COPY 1 OF 3

Dear George:

The enclosed proposal covers added development work on System 3 resulting from early production and field operation experience. Performance tests on the first few production units indicated that we were not getting the same performance characteristics as had been obtained in the laboratory-built prototype, particularly with regard to sensitivity. Additional development and design work was undertaken to modify the production design so that its performance would more closely approximate that of the engineering prototype. A number of additional changes were required to improve the reliability and correct certain deficiencies appearing in the early production models. These items are listed in more detail in the Statement of Work. In order to incorporate as much improvement in the early production units as possible, design work was undertaken immediately where it was indicated that changes must be made. Some additional development work also appears desirable but has not yet been done. These items are set forth separately in more detail in the Statement of Work.

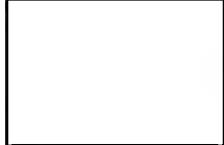
Wherever possible, changes were incorporated immediately in the production units. However, certain changes, particularly the cabling modification to maintain maximum sensitivity and the change in I-F transformer design, could not be made in time to incorporate them in the early production units.

We believed it to be more important to make early shipments without these changes in order to get the system in operation in the field. Despite reduced sensitivity and reliability, the systems shipped will meet the major portion of their performance capability. These design modifications can be made later on a retrofit basis.

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Enclosures:

Copies 1-3 of 4 of the following documents:  
CMCC 1131X5.66  
CMCC 1132X5.74

Sincerely,

*Dean*  
Dean

DOCUMENT NO. 21  
NO CHANGE IN CLASS  
NOT CLASSIFIED  
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STATEMENT OF ADDED WORK  
DEVELOPMENT OF SYSTEM 3

As a result of field operation and early production experience with System 3, a number of problems have arisen which necessitate added engineering development work to improve performance, increase the reliability of operation, improve the ease of maintenance, and simplify manufacture of the system. To meet urgent schedule requirements, the Contractor has had to supply engineering, labor, facilities, and materials necessary to perform the following additional System 3 development work:

1. Make design changes to maintain a maximum realizable sensitivity for the system without incurring degraded performance due to the presence of spurious signals in production models of the system. Maintaining the high sensitivity obtained with engineering models under laboratory conditions has proved difficult in equipment built by production personnel and methods and operated under field conditions. Additional development work has been required to redesign the cable harness in the receiver chassis plate assembly to reduce undesired leakage coupling between wires. Coaxial shielded connectors have been added at some cabling points carrying the r-f currents. Additional by-pass filtering was required on supply and low-frequency lines.
2. Improve reliability in several areas.
  - (a) It has been found desirable to improve the design of the 28- and 18-megacycle i-f transformer.<sup>5</sup> The commercial items used in the original design have proved to be mechanically inadequate in operation. Repeated tuning has resulted in cracking of the tuning slugs and winding cores.
  - (b) The marker pulse, consisting of a single broad pulse, required modification to raise the reliability of count of the 1-kc reference tone, to improve reproduction by the recorder, and to reduce interference with the lock-on signal in those instances when the lock-on signal appears close to the marker pulse. Circuit changes were required in both receiver and test set.
  - (c) During System 3A operation, a modified marker pulse is used. To accommodate this, the test set

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circuit which senses the presence of the marker pulse has required modification.

3. Correct problems which have appeared in the early stages of production.
  - (a) The tolerance required in the time interval established by the pulses which are associated with frequency information has required broadening in production assemblies. In addition to requiring a minor change in circuit design, a corresponding change has been required in the test set to accommodate the tolerance in the form of an added control.
  - (b) Variations in the stray capacity on etched board circuits due to variations in etched board thicknesses and dielectric constants have required a modification in a number of coil inductances and in the coupling capacity between the first local oscillator and mixer.
  - (c) During more extended use, insulation breakdown has occurred through a sheet of insulating material lying between the etched board circuitry and a mounting bracket, requiring the replacement of the original material by a new and heavier insulation. Another source of insulation breakdown has been an insulating plastic layer applied to the surface of the shield cans; again, in more extended use this material has proven to have insufficient surface hardness and has been replaced by a separate insulating sheet.
4. Modify affected production drawings; and, because the changes were taking place simultaneously with early production, provide the engineering liaison with production necessary to insure that the changes were incorporated at the earliest possible time.

In addition to the above added work already undertaken, the Contractor proposes to supply engineering, labor, facilities, and materials necessary to perform the following additional System 3 development work:

1. To improve reliability:
  - (a) Modification of etched circuit board connectors which have proven to be a source of failure in test and field operation.
  - (b) Design an improved connector in the component mounting holes in the etched circuit boards. Differences in thermal expansion between plating

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and base materials produce unreliable connection.

2. To improve the ease of maintenance by adding test points to the encapsulated assemblies to make them more accessible for checking during maintenance.
3. To correct the following problems appearing in production units:
  - (a) The original fabrication plan was based upon a quantity of nine units. Drill templets were prepared as a means of accomplishing fabrication with a minimum of associated drawing effort. Templets, such as those assembled to fabricate the chassis plate are quite complex and are inadequate to handle the larger quantities of production later required. Additional design time is required to replace these templets by drill jigs suitable for larger quantities.
  - (b) Variations in circuit behavior have created several difficulties in the third-local-oscillator assembly. The 20-kc bias voltage generated in the airborne recorder has been found to feed back and disrupt lock-on of the receiver in some instances, although this did not appear during engineering tests. The addition of filter circuits is required to correct this condition. Similarly, undesirable transients have appeared in the pulse-generating circuits which were not encountered in earlier tests, requiring circuit modification.
  - (c) Variations in circuit behavior due to temperature changes require more extensive environmental testing of production assemblies and modification of circuits.
4. To make necessary changes in the affected production drawings and to provide necessary liaison with the production organization.

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